

CLAIMS:

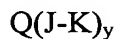
1. A curable composition, comprising:

a functionalized poly(arylene ether);

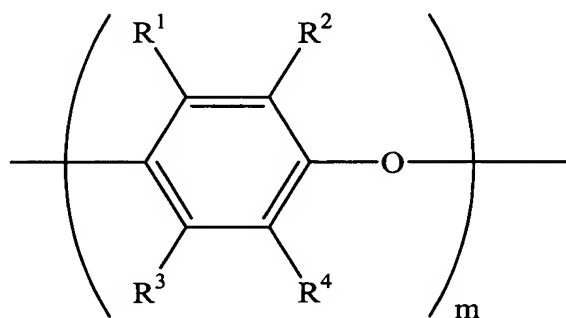
an olefinically unsaturated monomer; and

a nanofiller.

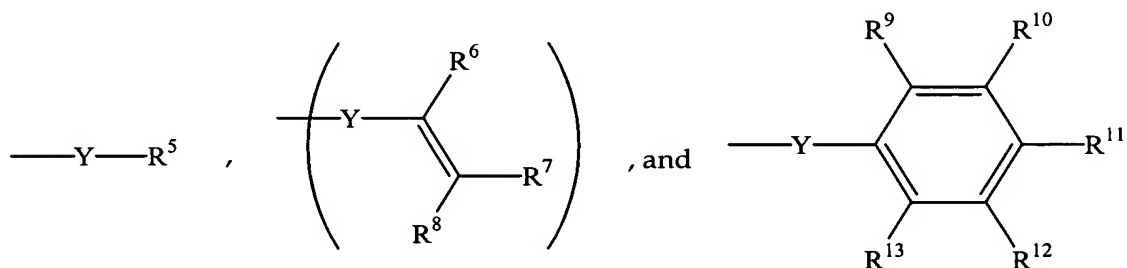
2. The composition of claim 1, wherein the functionalized poly(arylene ether) is a capped poly(arylene ether) having the structure



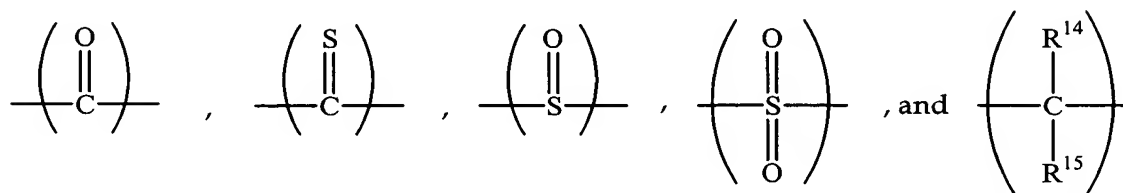
wherein Q is the residuum of a monohydric, dihydric, or polyhydric phenol; y is 1 to 100; J comprises repeating structural units having the formula



wherein R^2 and R^4 are each independently selected from halogen, primary or secondary C_1 - C_{12} alkyl, C_2 - C_{12} alkenyl, C_2 - C_{12} alkynyl, C_1 - C_{12} aminoalkyl, C_1 - C_{12} hydroxyalkyl, phenyl, C_1 - C_{12} haloalkyl, C_1 - C_{12} hydrocarbonoxy, and C_2 - C_{12} halohydrocarbonoxy wherein at least two carbon atoms separate the halogen and oxygen atoms; R^1 and R^3 are each independently selected from hydrogen, halogen, primary or secondary C_1 - C_{12} alkyl, C_2 - C_{12} alkenyl, C_2 - C_{12} alkynyl, C_1 - C_{12} aminoalkyl, C_1 - C_{12} hydroxyalkyl, phenyl, C_1 - C_{12} haloalkyl, C_1 - C_{12} hydrocarbonoxy, and C_2 - C_{12} halohydrocarbonoxy wherein at least two carbon atoms separate the halogen and oxygen atoms; m is 1 to about 200; and K is a capping group selected from the group consisting of



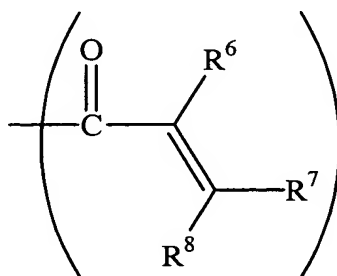
wherein R^5 is C_1 - C_{12} alkyl; R^6 - R^8 are each independently selected from hydrogen, C_1 - C_{12} alkyl, C_2 - C_{12} alkenyl, C_6 - C_{18} aryl, C_7 - C_{18} alkyl-substituted aryl, C_7 - C_{18} aryl-substituted alkyl, C_2 - C_{12} alkoxy carbonyl, C_7 - C_{18} aryloxy carbonyl, C_8 - C_{18} alkyl-substituted aryloxy carbonyl, C_8 - C_{18} aryl-substituted alkoxy carbonyl, nitrile, formyl, carboxylate, imidate, and thiocarboxylate; R^9 - R^{13} are each independently selected from hydrogen, halogen, C_1 - C_{12} alkyl, hydroxy, and amino; and wherein Y is a divalent group selected from the group consisting of



wherein R^{14} and R^{15} are each independently selected from hydrogen and C_1 - C_{12} alkyl.

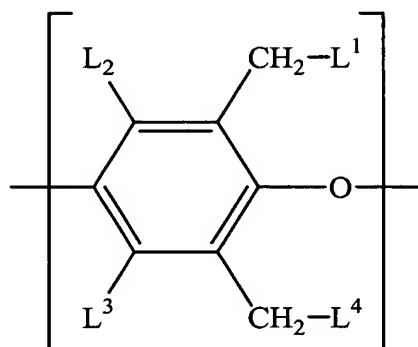
3. The composition of claim 2, wherein Q is the residuum of a monohydric phenol.

4. The composition of claim 2, wherein the capped poly(arylene ether) comprises at least one capping group having the structure

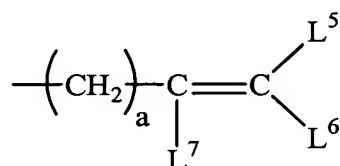


wherein R^6 - R^8 are each independently selected from hydrogen, C_1 - C_{12} alkyl, C_2 - C_{12} alkenyl, C_6 - C_{18} aryl, C_7 - C_{18} alkyl-substituted aryl, C_7 - C_{18} aryl-substituted alkyl, C_2 - C_{12} alkoxy carbonyl, C_7 - C_{18} aryloxy carbonyl, C_8 - C_{18} alkyl-substituted aryloxy carbonyl, C_8 - C_{18} aryl-substituted alkoxy carbonyl, nitrile, formyl, carboxylate, imidate, and thiocarboxylate.

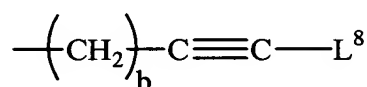
5. The composition of claim 1, wherein the functionalized poly(arylene ether) is a ring-functionalized poly(arylene ether) comprising repeating structural units having the formula



wherein each L^1 - L^4 is independently hydrogen, an alkenyl group, or an alkynyl group; wherein the alkenyl group is represented by



wherein L^5 - L^7 are independently hydrogen or methyl, and a is an integer from 1 to 4; wherein the alkynyl group is represented by



wherein L^8 is hydrogen, methyl, or ethyl, and b is an integer from 1 to 4; and wherein about 0.02 mole percent to about 25 mole percent of the total L^1 - L^4 substituents in the ring-functionalized poly(arylene ether) are alkenyl and/or alkynyl groups.

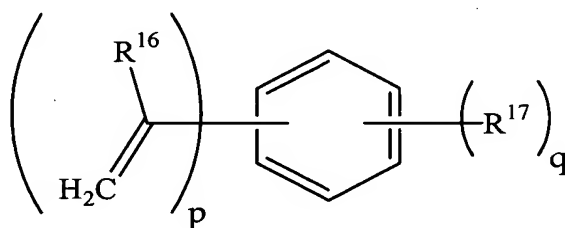
6. The composition of claim 1, comprising about 1 to about 90 parts by weight of the functionalized poly(arylene ether) per 100 parts by weight total of the functionalized poly(arylene ether) and the olefinically unsaturated monomer.

7. The composition of claim 1, wherein the olefinically unsaturated monomer comprises an alkenyl aromatic monomer, an acryloyl monomer, an allylic monomer, or a mixture thereof.

8. The composition of claim 1, comprising about 10 to about 99 parts by weight of the olefinically unsaturated monomer per 100 parts by weight total of the functionalized poly(arylene ether) and the olefinically unsaturated monomer.

9. The composition of claim 1, wherein the olefinically unsaturated monomer comprises an alkenyl aromatic monomer.

10. The composition of claim 9, wherein the alkenyl aromatic monomer has the structure



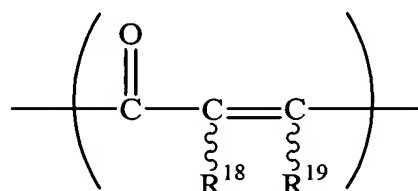
wherein each R^{16} is independently selected from hydrogen, $\text{C}_1\text{-C}_{12}$ alkyl, $\text{C}_2\text{-C}_{12}$ alkenyl, $\text{C}_2\text{-C}_{12}$ alkynyl, and $\text{C}_6\text{-C}_{18}$ aryl; each R^{17} is independently selected from halogen, $\text{C}_1\text{-C}_{12}$ alkyl, $\text{C}_1\text{-C}_{12}$ alkoxy, and $\text{C}_6\text{-C}_{18}$ aryl; p is 1 to 4; and q is 0 to 5.

11. The composition of any of claim 9, wherein the alkenyl aromatic monomer comprises is selected from styrene, alpha-methylstyrene, 2-methylstyrene, 3-methylstyrene, 4-methylstyrene, 2-t-butylstyrene, 3-t-butylstyrene, 4-t-butylstyrene, 1,3-divinylbenzene, 1,4-divinylbenzene, 1,3-diisopropenylbenzene, 1,4-diisopropenylbenzene, styrenes having from 1 to 5 halogen substituents on the aromatic ring, and mixtures thereof.

12. The composition of claim 9, comprising about 10 to about 99 parts by weight of the alkenyl aromatic monomer per 100 parts by weight total of the functionalized poly(arylene ether) and the alkenyl aromatic monomer.

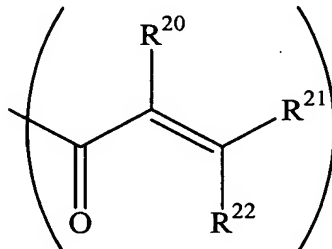
13. The composition of claim 1, wherein the olefinically unsaturated monomer comprises an acryloyl monomer.

14. The composition of claim 13, wherein the acryloyl monomer comprises at least one acryloyl moiety having the structure



wherein R^{18} and R^{19} are each independently selected from the group consisting of hydrogen and C_1 - C_{12} alkyl, and wherein R^{18} and R^{19} may be disposed either *cis* or *trans* about the carbon-carbon double bond.

15. The composition of claim 13, wherein the acryloyl monomer comprises at least one acryloyl moiety having the structure



wherein R^{20} - R^{22} are each independently selected from the group consisting of hydrogen, C_1 - C_{12} alkyl, C_2 - C_{12} alkenyl, C_6 - C_{18} aryl, C_7 - C_{18} alkyl-substituted aryl, C_7 - C_{18} aryl-substituted alkyl, C_2 - C_{12} alkoxy carbonyl, C_7 - C_{18} aryloxy carbonyl, C_8 - C_{18} alkyl-substituted aryloxy carbonyl, C_8 - C_{18} aryl-substituted alkoxy carbonyl, nitrile, formyl, carboxylate, imidate, and thiocarboxylate.

16. The composition of claim 15, wherein the acryloyl monomer comprises at least two acryloyl moieties.

17. The composition of claim 13, wherein the acryloyl monomer comprises at least one acryloyl monomer selected from trimethylolpropane tri(meth)acrylate, 1,6-hexanediol di(meth)acrylate, ethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, cyclohexanedimethanol di(meth)acrylate, butanediol di(meth)acrylate, diethylene glycol di(meth)acrylate, triethylene glycol di(meth)acrylate, isobornyl (meth)acrylate, methyl (meth)acrylate, and mixtures thereof.

18. The composition of claim 13, comprising about 1 to about 50 parts by weight of the acryloyl monomer per 100 parts by weight total of the functionalized poly(arylene ether) and the acryloyl monomer.

19. The composition of claim 1, wherein the olefinically unsaturated monomer comprises an allylic monomer selected from diallyl phthalate, diallyl isophthalate, triallyl mellitate, triallyl mesate, triallyl benzenes, triallyl cyanurate, triallyl isocyanurate, mixtures thereof, and partial polymerization products prepared therefrom.

20. The composition of claim 1, wherein the nanofiller is selected from metal oxides, metal carbides, cermet materials, ceramics, glass, perovskites, layered inorganic materials, fibrillar inorganic materials, and combinations thereof.

21. The composition of claim 1, comprising about 0.5 to about 80 weight percent nanofiller, based on the total weight of the composition.

22. The composition of claim 1, further comprising a curing catalyst.

23. The composition of claim 22, wherein the curing catalyst comprises at least one curing catalyst selected from the group consisting of benzoyl peroxide, dicumyl peroxide, methyl ethyl ketone peroxide, lauryl peroxide, cyclohexanone peroxide, t-butyl hydroperoxide, t-butyl benzene hydroperoxide, t-butyl peroctoate, 2,5-dimethylhexane-2,5-dihydroperoxide, 2,5-dimethyl-2,5-di(t-butylperoxy)-hex-3-yne, di-t-butylperoxide, t-butylcumyl peroxide, alpha,alpha'-bis(t-butylperoxy-m-isopropyl)benzene, 2,5-dimethyl-2,5-di(t-butylperoxy)hexane, dicumylperoxide, di(t-butylperoxy isophthalate, t-butylperoxybenzoate, 2,2-bis(t-butylperoxy)butane, 2,2-bis(t-butylperoxy)octane, 2,5-dimethyl-2,5-di(benzoylperoxy)hexane, di(trimethylsilyl)peroxide, trimethylsilylphenyltriphenylsilyl peroxide, 2,3-dimethyl-2,3-diphenylbutane, 2,3-trimethylsilyloxy-2,3-diphenylbutane, methacryloxypropyl trimethoxysilate, ethoxylated bisphenol A di(meth)acrylate, and mixtures thereof.

24. The composition of claim 1, further comprising a non-nanofiller.

25. The composition of claim 1, further comprising an additive selected from the group consisting of flame retardants, mold release agents and other lubricants, antioxidants, thermal stabilizers, ultraviolet stabilizers, pigments, dyes, colorants, anti-static agents, conductive agents, curing promoters, and combinations thereof.

26. The composition of claim 1, further comprising a polymeric additive having a glass transition temperature less than or equal to 100°C.

27. A curable composition, comprising:

a (meth)acrylate-capped poly(2,6-dimethyl-1,4-phenylene ether);

an acryloyl monomer comprising at least two acryloyl moieties; and

a nanofiller.

28. A curable composition, comprising:

about 1 to about 90 parts by weight of a (meth)acrylate-capped poly(2,6-dimethyl-1,4-phenylene ether);

about 10 to about 99 parts by weight of an acryloyl monomer comprising at least two acryloyl moieties; and

about 0.5 to about 80 weight percent of a nanofiller;

wherein the amounts of the (meth)acrylate-capped poly(2,6-dimethyl-1,4-phenylene ether) and the acryloyl monomer are based on 100 parts by weight total of these components, and the amount of the nanofiller is based on the total weight of the composition.

29. A cured composition formed by curing the composition of claim 1.

30. A method of making a curable composition comprising

combining a nanofiller with a polymer to form a masterbatch;

mixing the masterbatch with a functionalized poly(arylene ether) and an olefinically unsaturated monomer.

31. A method of making a curable composition comprising

combining a nanofiller with a solvent to form a dispersion;

mixing the dispersion with a functionalized poly(arylene ether) and an olefinically unsaturated monomer.

32. The method of claim 31, wherein the dispersion further comprises a swelling agent, a compatibilizing agent, a swelling/compatibilizing agent, or a combination thereof.

33. The method of claim 31 wherein the mixing has a mixing energy of less than 50 kilojoules per liter, based on the volume at 25°C of the composition being mixed.